

Remarks

Following the previous amendment submitted October 26 and November 30, 2005, nine claims (14-22) remained in the application, of which one (14) was independent. Claim 14 has been amended herein to specify that the infiltration is primarily by capillary action. No other amendments have been made to claims. Thus, nine claims remain (14-22).

The present amendment to claim 14 is to add a limitation that was inadvertently omitted, but which was made to the parent case (now U.S. Patent No. 6,719,948) and was intended to have been made herein. This limitation requires that the infiltration be primarily by capillarity.

The present claims are in condition for allowance, as the arguments below explain.

Claims 14-22 would have been non-obvious over GB '041 alone, and in combination

The Office Action has rejected claims 14-19, 21 and 22 as being unpatentable under 35 U.S.C. §103(a) (non-obviousness) over British patent, GB 613,041. The Office Action also rejects claim 20 as being unpatentable over GB 613,041 in further light of Banerjee.

Applicants believe that the rejection may stem from a misunderstanding of the applicants' arguments made in response to the previous Office Action. The Office Action, in ¶1, states that "[t]he Examiner does not find Applicant's argument persuasive. In particular, the Examiner does find that reference teaches that the infiltrant at least partially diffuses into the matrix." The Office Action states further, in ¶3, that "GB '041 discloses... [t]he infiltrant fuses with the matrix metal

(page 2, line 33-38), the term meeting the limitation of diffusing."

Applicants respectfully submit that applicants did not argue that the reference failed to teach diffusion of infiltrant into the matrix. Applicants argued, at p. 6, ¶1 - p. 7, that the reference fails to teach solidification of the liquid infiltrant by diffusion, as opposed to solidification by merely cooling. The prior art does not show, teach, or render to have been obvious a step that involved solidification by diffusion.

Before discussing the rejection in detail, a brief review of the claims, taken largely from the Abstract, may again be instructive. An infiltrant quickly fills a porous metal skeleton. As a melting point depressant diffuses into the skeleton powder, the liquid infiltrant undergoes diffusional solidification and the body subsequently homogenizes. Maintaining the infiltrant at a liquidus composition for the infiltration temperature typically ensures that the bulk composition or properties will remain uniform throughout the part, particularly in the direction of infiltration. In particular, it is helpful to achieve uniform composition in the direction of infiltration if factors are chosen so that the relative ratios of components other than melting point depressant, in the liquid infiltrant not yet solidified, remain substantially constant.

Thus, it is understood, that for the limitations of the claims to be met, there must be some diffusional solidification that takes place. Solidification can not take place entirely by cooling.

Diffusional solidification means, generally, that solidification takes place because the composition of the liquid has changed as a result of diffusion, so that the

resulting composition solidifies at the conditions under which the pre-diffusion composition would have remained liquid. Thus, solidification by cooling, where the composition of the liquid remains the same, is not diffusional solidification. And, of course, diffusion, with no solidification, is not diffusional solidification.

The '041 patent describes solidification by cooling in many cases, and diffusion with no concurrent solidification after solidification. But not solidification by diffusion.

The '041 patent describes using a similar alloy with a reduced melting temperature relative to a skeleton. In all instances, where it explicitly contemplates solidification of the body, it specifies that solidification take place by cooling the infiltrated body to a temperature below the melting temperature of the infiltrant to freeze it. That is, to solidify it, not by diffusion. In some instances, it mentions to cool the body to slightly below that melting point, thereby freezing it, so that presumably solid state diffusion takes place after solidification, to achieve a uniform concentration of the diffusing species within the regions that formerly were infiltrant, and skeleton.

The portion of GB '041 cited by the Office Action to meet this point, p. 2, lines 33-39, explicitly contemplates only solidification by cooling. Line 22 states, "After infiltration is completed, the body and melt absorbed therein... are chilled energetically so as to cool them to that freezing temperature [865°C - freezing temperature of composition], abstract the latent heat of fusion of the infiltrated melt and cause it to freeze before diffusion of zinc from the melt into the solid material progresses so far that the latter's melting point is reduced and it softens." (Emphasis added.)

See also GB '041 p. 2, lines 70-83 (copper zinc system) and p. 3, l. 37-40 (solid state diffusion); and a ferrous system, p. 4, l. 26-36; p. 4, l. 77-90; line 110; p. 5, l. 121-127.

The '041 patent never mentions solidification by diffusion. In fact, quite the converse takes place. The diffusion mentioned in the '041 patent all takes place after solidification.

Thus, Applicants were not arguing that the GB '041 patent does not teach diffusion. Applicants argued that the GB '041 patent does not teach solidification by diffusion. Merely that diffusion occurs, does not mean that solidification takes place. In fact, most, if not all instances in which GB '041 mentions diffusion are explicitly solid state diffusion. And thus, none are explicitly liquid state diffusion. None are diffusion that results in solidification.

Another claims feature not addressed by the Office Action or shown in any reference or combination thereof is achieving uniform composition along the direction of infiltration, typically vertically. The '041 patent does not discuss the problem of achieving uniform composition along the direction of infiltration. The present claims under rejection each require (by virtue of claim 14, from which all depend):

the infiltrant having a composition that is a liquidus composition for an infiltration temperature, the liquidus composition and infiltration temperature chosen as set forth below regarding keeping the relative ratios relatively constant; and

subjecting the infiltrated skeleton to conditions such that a portion of said melting point depressant diffuses from the infiltrated

porosities into the metal powder, and at least partial diffusional solidification occurs; and

choosing the metal powder composition, melting point depressant, infiltrant composition and infiltration temperature such that during diffusional solidification of the infiltrant, relative ratios, of components other than melting point depressant, in the liquid infiltrant not yet solidified, remain substantially constant.

Regarding the uniform composition along the direction of infiltration, please see the specification at pp. 9-11, Figs. 1, 2, 3, for a binary system and pp. 12-14, Figs. 18-20, for ternary systems.

Nothing in the British '041 patent mentions the underlined properties regarding, infiltrant composition and liquidus; partial diffusional solidification, and the constancy of the ratio of components of the infiltrant during diffusional solidification.

These claimed features enable the uniform composition along the direction of infiltration. Thus, although the limitations may seem subtle, these limitations are significant. Reconsideration and withdrawal of the rejection in light of these remarks is respectfully requested.

It is not at all understood how the Office Action finds any obviousness regarding these limitations. No arguments are given in the Office Action regarding these important limitations.

The Office Action has stated that the reference "meet[s] the limitation of diffusing." From this mention of "diffusing" without mention of solidification, the Applicant believes that the Office Action evidences a misunderstanding of Applicant's arguments, as discussed

above. Solidification by diffusion is required, not mere diffusion.

Further, GB '041 doesn't at all mention that the infiltrant have a composition that is a liquidus composition. Further, it doesn't seem likely that this is inherently so. The Liquidus line is the line labeled as such in Fig. 1 of the application. All compositions to the right and above the line are fully liquid, while compositions to the left and below the line (and within the closed in, curved sided triangular region) are mixtures of liquid and solid. Thus, the claim requires that, the composition of the infiltrant must be along this line; and not only that, but that infiltration take place at the temperature where the composition is on the line. For instance, a composition of 10% skeletal material (dotted vertical line) on Fig. 1 is a liquidus composition, but only for a T of 1250°C (horizontal dotted line). It is not a liquidus composition for a T above or below 1250°C. Thus, for the claim to be rendered to have been obvious, by GB '041, infiltration must take place with an infiltrant at that composition and also, at that temperature. Nothing of the sort is shown in the '041 reference, or the others cited in combination with it.

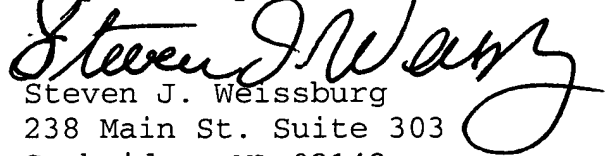
Thus, for the foregoing reasons, it is respectfully submitted that the prior art does not render the claimed invention to have been obvious. Reconsideration and withdrawal of the rejections is requested.

Please note that an Information Disclosure Statement was mailed in by regular procedure on April 26, 2006. The Examiner is familiar with the reference, U.S. Patent 4,705,203, entitled REPAIR OF SURFACE DEFECTS IN SUPERALLOY ARTICLES, issued to McComas et al., which was cited in a Notice of Allowability dated February 3, 2006 in related U.S. case, U.S. Pat. App. No. 10/276,457.

The undersigned respectfully requests a telephone interview with the Examiner to resolve the misunderstanding. The undersigned will telephone the Examiner after about May 14. The Examiner is invited to telephone the undersigned at any time before then to discuss this application.

This response is being filed within TWO months after the mailing of the final Office Action, thus invoking the advisory provisions of 37 CFR 1.136(a) and MPEP 714.12 and 714.13, mentioned in ¶5 of the Office Action.

Respectfully submitted,



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May 2, 2006

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